The Canadian Entomologist.

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ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The annual meeting was held in the rooms of the Natural History Society, Montreal, on Thursday, August 24, 1882, at 3 o'clock, p. m.

The President, Mr. Wm. Saunders, of London, Ont., in the chair.

Present: H. F. Bassett, Waterbury, Conn.; Rev. C. J. S. Bethune, M. A., Port Hope; G. J. Bowles, Vice-President, Montreal; F. B. Caulfield, Montreal; Prof. J. H. Comstock, Cornell University, Ithaca, N. Y.; Prof. A. J. Cook, Agric. College, Lansing, Mich.; Wm. Couper, Montreal; T. Craig, Montreal; J. M. Denton, London; C. R. Dodge, Washington, D. C.; Prof. C. H. Fernald, State Coll., Orono, Maine; C. Fish, Brunswick, Maine; Jas. Fletcher, Ottawa; Rev. F. W. Fyles, Cowansville, P. Q.; Prof. H. A. Hagen, Mus. Comp. Zool., Cambridge, Mass.; W. H. Harrington, Ottawa; Prof. S. Henshaw, Boston, Mass.; Dr. P. R. Hoy, Racine, Wis.; J. G. Jack, Chateauguay Basin, P. Q.; Dr. H. S. Jewett, Dayton, Ohio; Prof. J. A. Lintner, State Entomologist, Albany, N. Y.; H. H. Lyman, Montreal; B. Pickman Mann, Assist. Entomologist Agricul. Dept., Washington, D. C.; Prof. C. V. Riley, Entomologist Ag. Dept., Washington, D. C.; Wm. Shaw, Montreal; E. D. Winble, Montreal; C. D. Zimmerman, Buffalo, N. Y.; E. Baynes Reed, Sec.-Treas., London, and others.

The minutes of the previous meeting were confirmed, the reading being dispensed with as they had been printed and sent to the members.

The President then addressed a few words of cordial welcome to the members present.

The report of the Council and the financial statement of the Sec.-Treas. for the past year were then read, and on motion, adopted.

The report of the Montreal Branch was submitted and read to the meeting.

The election of officers then took place, when the following gentlemen were duly elected:

President—Wm. Saunders, London.

Vice-President—G. J. Bowles, Montreal.

Secretary-Treasurer and Librarian—E. Baynes Reed, London.

Council--Rev. C. J. S. Bethune, Port Hope; J. Fletcher, Ottawa; Rev. F. W. Fyles, Cowansville; W. Couper, Montreal; J. M. Denton, London; J. Alston Moffatt, Hamilton; W. H. Harrington, Ottawa.

Editor of Canadian Entomologist—Wm. Saunders.

Editing Committee—Rev. C. J. S. Bethune, J. M. Denton, E. B. Reed.

Auditors—H. B. Bock and C. Chapman, London.

The President then delivered his annual address, for which he was unanimously tendered a vote of thanks, accompanied with a request to publish it in the CANADIAN ENTOMOLOGIST.

ADDRESS OF THE PRESIDENT. – Saunders

GENTLEMEN,—For the first time in the history of our Society, we meet within the limits of the Province of Quebec. Although belonging to Ontario, and sustained in our work mainly by the liberal aid granted us by the Government of Ontario, our sphere of usefulness extends throughout the length and breadth of this great Dominion, and also across the lines into the United States. We have long had an active branch of our Society in Montreal, comprising members who have materially aided in the advancement of Entomological science, and now at this particular juncture, when so large a body of distinguished scientists were to honor Montreal with their presence, and among them many noted Entomologists, no time, it was thought, could be more opportune than this in which to hold the annual meeting of our Society, and by the kind permission of the Hon. S. C. Wood, Commissioner of Agriculture for the Province of Ontario, we are privileged to meet here on this occasion.

During the past season that dreaded pest, the Hessian Fly, has prevailed to a considerable extent in Ontario. My attention was first called to it this season during the last week in July, when the grain was ripening. On visiting wheat fields in the vicinity of London, I found the insect very prevalent, and in some instances I believe the injury to the crop must have been fully twenty per cent. The affected stalks were lying on the ground, and the grain in the heads imperfectly developed; on pulling these they would often break at the point where the insect had been at work, that is, about the base of the first or second joint. On examining the affected stalks, the insect was found to be in what is known as the

puparium or flax-seed state, from the resemblance which it bears in this condition to a grain of flax-seed. The attention of farmers was drawn to the depredations of the insect by a communication to the press, and information sought as to the extent of the evil. From letters received from various sections of the Province, it is evident that the insect prevails over an extended area, and that the sum total of the loss entailed on the agricultural community in Ontario from this cause would figure up to a large sum, probably hundreds of thousands of dollars. In 1876 and 1877 this insect appeared in considerable force and seriously injured the wheat crop in many parts of our Province, but since that time we have enjoyed comparative immunity from it until now.

The Hessian Fly belongs to the order of Diptera, or two-winged insects, and is about one tenth of an inch long, with dusky transparent wings fringed with fine hairs. There are two broods during the year. The flies which appear in the autumn deposit their eggs from one to twenty or more on a plant in the cavities between the ridges of the blades or between the stalk and sheathing base near the roots of the young fall wheat. These hatch in four or five days into tiny grubs, soft, smooth and shining, which work their way down the leaf to the base of the sheath, about the crown of the root. Here they fasten themselves head downwards to the tender stalk, live upon the sap and gradually become imbedded more or less in the substance of the stalk. When once located the larva moves no more, but growing rapidly, soon becomes plump, and when mature is about one sixth of an inch long, greenish, and semi-transparent; before long it changes to the flax-seed state, in which condition it remains throughout the winter. Early in spring the flies are produced, which deposit their eggs about the first or second joint of the stalk, where they pass through their several stages, assuming the flax-seed state a few weeks before the wheat ripens, from which the flies hatch in August and September.

The effect of the presence of this insect in the young fall wheat is to weaken the plants, which become unhealthy, turn yellow and sometimes die. Often there is a gall-like swelling or enlargement of the stalk near the base, in and about which the insects will be found. The unhealthy plants contrast strongly with the rich green of the vigorous uninjured grain. The late brood may be easily found by separating the leaf from the stalk of the young wheat in October or November; the early brood, as already stated, in the reclining stalks, which, when very numerous, makes the wheat appear as if "lodged" in patches.

Various measures have been recommended for the destruction of this insect. Some have advised the immediate threshing of the wheat and the burning of the straw, but since most of the insects are left in the stubble this would be labor lost. Tearing up the stubble with a cultivator immediately after harvest, and raking it into heaps and burning it, is another suggestion, but this involves much labor at a time when the farmer is extremely busy, and during the process many of the insects would necessarily be shaken out of the stalks and escape. Burning the stubble in the field where practicable is a much wiser course, but it must be borne in mind that this process involves the destruction of the friendly parasites which feed upon the enemy, as well as the enemy itself. In my address to you two years ago, I expressed the opinion that we were almost wholly indebted for such immunity as we enjoy from destructive insects to the insect parasites which destroy them; subsequent experience has confirmed this view, and any measure which involves the destruction of these useful friends should be adopted with caution. I am happy to state that from specimens reared within the past few days, I find that a large proportion of the Hessian Fly is being destroyed by parasites this season. Late sowing has been much recommended, and the results seem to prove that on the whole this is the most practicable remedy—to defer sowing until about the 20th of September, by which time most of the flies will have disappeared; late sowing, however, has the disadvantage that the plants not being so well established, are not as well fitted to withstand the severe weather of the winter. High culture is advantageous, as the luxuriant growth which the young wheat makes under such circumstances will enable it better to withstand the weakening effects of the grubs. Among the other measures recommended are pasturing the wheat fields with sheep, and the application of lime to the young wheat to kill the larvæ.

During the past few weeks I have examined the roots of a number of sickly-looking grape vines about London, Ontario, and have found the root-inhabiting form of the *Phylloxera vastatrix*, the dreaded scourge of the vine in Europe, in considerable numbers on the young rootlets, and have been able to clearly trace the diseased condition of those vines to that cause. I am convinced that this insect prevails to a greater extent than may at first be suspected throughout our Province, and that it is inflicting material injury, for besides having found it common about London, I have satisfactory evidence of its presence in the neighborhood of Grimsby, where many vines are reported as diseased, and have also

found it recently injuring the vines at Paris. There are no symptoms which indicate the first onset of this insect; it is only after the Phylloxera has destroyed a large portion of the roots, that the vine assumes a sickly aspect, becoming stunted in its growth and yellow in the foliage. On examining the roots of a vine so affected, most of the small rootlets—through which the vine draws the chief part of its nourishment—are found dead and with many small knots and swellings on them. If a few freshly formed, living rootlets can be found, which may in such cases be looked for about the crown of the vine, these minute lice will usually be seen clustering upon them, often surrounded by groups of their eggs, and causing little swellings thereon; but it frequently happens that when the vines have reached this depleted condition, no insects can be found; they have entirely left them, and traversing the interlacing roots of other vines, found their way to richer pastures.

This insect occurs in two very different forms; in one, known as the gall-inhabiting type, it is found upon the vine leaves, producing in June, July and August globular or cup-shaped galls of varying sizes, of a greenish red or yellowish color, with their outer surface uneven and somewhat woolly. The enlargement is on the under side of the leaf, and if one is cut into, it will be found to contain from one to four orange colored, wingless lice, and a large number of very minute, oval, pale yellow eggs, with some newly hatched lice. Soon the gall becomes too thickly populated, when the surplus lice wander off through its partly opened mouth on the upper side of the leaf, and establish themselves on the same leaf or on adjoining younger leaves, where the irritation occasioned by their punctures causes the formation of new galls, within which the lice mature and increase. These galls are quite common, especially on leaves of the Clinton and other thin-leaved varieties, also on the wild grape; they sometimes occur in such abundance as to cause the leaves to turn brown and fall prematurely from the vine, and instances are recorded of defoliation from this cause. Late in the season, as the leaves become less succulent, the lice either perish or seek other quarters, and some of them find their way to the roots of the vines and establish themselves as already described, where, with their change of habit, there follows a slight difference in their appearance. During the winter they remain torpid, renewing their activity in spring. As the summer advances, a portion of the root lice acquire wings, when they issue from the ground, and rising in the air, they fly or are carried with the wind to neighboring vineyards, where they

deposit eggs on the under side of the leaves, among their downy hairs, beneath the loosened bark of the branches and trunk, or in crevices of the ground about the base of the vine. The complete life history of this insect, which is extremely interesting and curious, may be found in the 5th, 6th, 7th and 8th Reports on the Insects of Missouri, by Prof. C. V. Riley.

The gall-inhabiting type of this insect may be subdued by picking off the infested leaves and destroying them, but the root-inhabiting type is a much more difficult form to deal with. Various applications to the soil have been recommended, such as bisulphide of carbon, and carbolic acid diluted with water and poured into holes made in the soil about the roots; soot, lime and ashes have also been suggested, strewed around the vines.

Several species of predaceous insects prey on this louse. The larva of a small fly, an undetermined species of *Diplosis*, deposits its eggs within the gall, in which the larval and pupal stages are also passed. The larva of this friendly species, although destitute of legs, is very active, and groping about within the hollow of the gall, seizes on the young lice as hatched and sucks them dry. I have found no evidence of its attacking the parent lice, the newly born and tender progeny being more to its taste, and in sufficient abundance to furnish it with a constant supply of fresh food. In some instances one larva, in others two are found in a single gall, but in no instance have I found living lice with the chrysalids, an evidence that its beneficial work is completed before this change takes place. An active mite, *Tyroglyphus phylloxera*, the larva of a Syrphus fly, *Pipiza radicans*, also the larva of a small dull-colored Lady-bird, a species of *Scymnus*, all aid in keeping in subjection the root-inhabiting form.

Most of our American vines are much more vigorous than the European sorts, and hence are likely to endure the inroads of this insect much better. As the insect is native to our country, our vines must have always been subject more or less to its attacks, and hence probably have developed a hardier constitution, with greater capacity for endurance or resistance. Last year I observed on some Concord vines evidences of unhealthiness, which I now believe arose from the presence of Phylloxera; this season most of them seem to have recovered their natural vigor. This inspires the hope that our vines may be able to endure the presence of this pest without very serious injury or loss.

During the month of July I received from Prof. J. A. Lintner, State

Entomologist of New York, specimens of parasitized eggs of the Gooseberry Sawfly, *Nematus ventricosus*, which he kindly sent me for the purpose of enabling me to introduce the parasite into Canada. This parasite is a very minute four-winged fly, probably *Trichogamma pretiosa*, with very delicate fringed wings. Some of these I placed while still unhatched near to eggs of the Sawfly recently laid on currant leaves. It is sincerely hoped that the effort for their introduction into Ontario will be successful, as they seem to do their work very thoroughly, every egg in the examples sent me being parasitized. The presence of the parasite may be detected by the discoloration of the egg, which becomes brown.

Recently I have received from a correspondent in Oakville, Mr. M. Felan, some examples of the destructive work of *Systena frontalis* on grape vine leaves. This beetle, although very generally distributed, has not, as far as I know, ever been recorded before as destructive or noxious. In this instance it seems to be quite local in its abundance, as my correspondent informs me that they are not found on his neighbor's vines, although very abundant and destructive on his own, eating the green tissues of the leaf on the upper side and causing it to wither.

Examples of what appears to be a new disease on the pea have lately been brought to my notice from several localities, under the impression that it was caused by an insect. The disease manifests itself in a series of white fleshy swellings at short intervals along the fibrous roots, varying in size from one-sixteenth of an inch to one-eighth of an inch or more in diameter, irregular in form, and of a solid fleshy structure. Microscopical examination has convinced me that it is a fungus growth in the production of which insects play no part. It appears to have the effect of stunting the growth of the plants and lessening the crop.

The short fruit crop this year, after the abundant promise of the spring, has been by many attributed to the work of insects, but this I am satisfied is an error, for while in many instances a small amount of injury has been done by insects, the main causes of the failure must be looked for elsewhere. Insects are important agents in the fertilization of fruit blossoms, and at the time of the abundant blossoming of the past season wet weather prevailed with an unusually low temperature, which prevented the insects then on the wing from visiting the flowers; the low prevailing temperature may have also interfered with the proper maturing of the fertilizing agent, while the frequent rains washed away from the opening

flowers much of the pollen as formed. To these causes combined may probably be attributed the lack of fertilization of the blossoms. Following this unfavorable weather, and doubtless induced and fostered by it, a species of minute fungus attacked the leaves, extending over a large portion of their surface, and often down the leaf-stalk to their base, causing a dark brown discoloration. This same fungus attacked the young fruit also, deforming a considerable proportion of the few specimens which were to be found, and these attacks resulted in a withering and curling of the leaves; the young fruit became stunted and deformed, and in many instances much of the foliage dropped to the ground. The effect of this injury, even at this advanced period in the season, is still to be seen in the sparseness of the foliage on many of the trees, in the discoloration of the leaves and the stunted growth of the branches.

It is difficult to anticipate with any certainty the effect of this disease on the fruit crop of next year, but since as a rule any interruption to the healthy growth of a tree leads to the more abundant production of fruit buds, it is probable that with a favorable season, we may have a very abundant yield in 1883.

California has for some years past been shipping fruits from her abundant surplus to all parts of the continent, and her favored climate furnished conditions under which pears, apples, plums and grapes prospered to an extent unknown elsewhere, and for many years almost free from the insect pests which in other fruit-growing regions levy so heavy a tax on the growers. But this exemption could not be expected to be permanent. The Codlin Moth made its appearance there in 1874, and ever since then has been increasing to an alarming extent, the climate favoring its propagation with a rapidity unknown in less favored districts, so that there are three, and in some instances four broods in a season. They attack the pears and quinces, as well as the apples, and destroy and disfigure a large quantity of fruit. California fruit growers are also suffering from the Phylloxera, Pear-tree Slug, Red Spider, Tussock Moth Caterpillar, the Currant Borer, a native Tent Caterpillar, *Clisiocampa constricta*, and a number of species of bark lice or scale insects, which attack apple, pear, peach, plum, orange, lemon, fig and olive trees, being found alike on the bark, foliage and fruit, and which multiply with amazing rapidity. Recognizing the vast importance of the fruit crop to the State, the most stringent measures are being enacted for the purpose of subduing these pests. An

Act was passed by the State Legislature in March, 1881, in the interests of horticulture and viticulture, providing for the appointment of a State Board of Commissioners, one from each of the large fruit-growing districts, with almost unlimited powers to restrain, seize, or prohibit the importation of anything and everything likely to aid in distributing these insect pests—any suspected vines, vine cuttings, trees, empty fruit boxes or other material likely to spread insects or contagion, and any willful violation of the quarantine regulations of this Board is considered a misdemeanor and punishable with a fine of from $25 to $100. These Commissioners are also charged with the duty of preparing rules to be observed by fruit growers for the extermination of insects, and suitable powers are given them to enforce the carrying out of these rules. In reference to the Codlin Moth, every apple grower is compelled to scrape the rough bark off his apple trees every spring, to collect and burn the scrapings, and apply, after scraping, an alkaline wash—the constituent parts of which are specified—to the tree. All boxes in which apples, pears or quinces have been stored or shipped are required to be dipped in boiling water containing a pound of commercial potash to each 25 gallons, for at least two minutes. These measures look to the destruction of the pupa. But, further, bands of cloth or paper of a specified width must be fastened around each apple, pear and quince tree, before the fifteenth day of May in each year, and examined every seventh day afterwards throughout the season, and all larvæ or pupæ destroyed. Precautionary and remedial measures are being enforced in reference to many other destructive insects, and any laxity or omission on the part of fruit growers in carrying out the instructions of the Commissioners is punishable by fine. The chief officer of the Commission is required to visit, examine and report upon the fruit growing interests in the various sections of the State, appoint resident inspectors for each county to enforce the regulations adopted by the Commission, and to experiment on the best methods of subduing insects and diseases destructive to fruits, and disseminate the information so obtained. For the carrying out of these objects an appropriation is made by the State of ten thousand dollars a year.

Those interested in Economic Entomology will, I am sure, watch with much interest the effect of such vigorous legislation, and if measures of this character can be successfully enforced there, why not elsewhere? There seems to be a necessity for the general adoption of some stringent measures which would prevent the careless and lazy from making their

grounds the breeding places of noxious insects which prey upon and destroy the crops of their more thrifty neighbors.

I have the honor to be,

Yours very sincerely,

WM. SAUNDERS.

There being no further business, the meeting of the Entomological Society of Ontario was then adjourned.

The meeting then resolved itself into an informal gathering of the Entomological members of the American Association for the Advancement of Science, then in session in the city of Montreal.

On motion, Mr. W. Saunders and Mr. E. B. Reed were requested to act as Chairman and Secretary respectively of the meeting.

Some discussion took place respecting the Entomological Club of the A. A. A. S., when it was moved by Dr. Hagen and seconded and duly carried :

Resolved,—That Prof. J. A. Lintner be requested to take the necessary steps to call further meetings of the Entomologists present at this session of the Association, at such times and places as might be determined on, and also to provide for similar meetings for Entomological discussions at the future annual gatherings of the Association.

PEA FUNGUS.

Mr. Geo. McCloskie, of Princeton, N. J., asked for some information about a peculiar fungus-like growth on pea roots, referred to in Mr. Saunders' address. The Chairman gave it as his opinion that it was a fungus.

Samples were shown exhibiting the pea as affected by this disease.

COTTON WORMS.

Mr. Jas. Fletcher asked if there was any further information respecting the habits of the Cotton Worm Moth, *Aletia argillacea*, he believing that from its frequent occurrence in Ontario in such a perfect condition, it must breed in Canada ; he was aware that the larva had never been found here and that Prof. Riley had in his able paper on this moth, expressed his conviction that the moth did not breed in Canada.

Prof. Riley stated that so far as he knew from repeated observations and experiments, the cotton plant, *Gossypium*, was the only food plant of this insect ; he thought that the peculiar formation of close-fitting scales

of the wings would account for the apparently fresh condition of the moths found in Ontario, and he believed that the insect possessed ample powers to fly such a distance as that from the Southern States to Canada. There might be a probability that the insect bred in the Northern States, but he was still of the opinion that the moth was a purely Southern species.

Dr. Hoy stated that he had found in Wisconsin a specimen of the moth at the end of August, with the fore and hind wing on one side of the body in a deformed and crippled state, evidently showing that it must have very recently emerged from the chrysalis. He also stated that a female moth had been captured near his residence about the middle of June. He thought the insect must breed in the North sometimes.

Prof. Comstock confirmed Dr. Hoy's statement as to the finding of the crippled moth, but thought, however, that the moth generally bred in the South.

Prof. Fernald said he had seen fresh specimens taken in Sept., in Maine.

The Chairman said that occasionally fresh moths and butterflies might be captured in entirely new localities, but that generally some probable reason could be given for their appearance ; as, for instance, he remembered that many years ago two fresh specimens of *Argynnis columbia* had been found at St. Catharines, Ont., a place where they had never before or since been observed, but that they had probably found their way there among the large number of fruit and other trees imported from the States ; still, however, no such probable reason had been suggested for the appearance of the Cotton Worm Moth in Ontario, in such frequent numbers and at so many different localities. The matter was one of great interest.

Mr. Fletcher said he hoped the members would continue their observations of this insect, the larva of which, if found in Canada, would probably feed on some *Malvaceous* plant.

(To be Continued.)

RE-PUBLICATION OF VOLUMES I. AND II.—In consequence of the demand from various European scientific societies and others for complete sets of the CANADIAN ENTOMOLOGIST, the Editing Committee have found it necessary to reprint the first and second volumes, which had been long out of print. The Society can now supply at the usual price copies of all the volumes, on application to the Sec.-Treas., Mr. E. Baynes Reed, London, Ont.

DESCRIPTION OF A NEW SPECIES OF COPÆODES.

BY W. H. EDWARDS, COALBURGH, W. VA.

COPÆODES WRIGHTII.

Male.—Expands .9 inch.

Upper side yellow-ochre color; costal margin of primaries black on the edge, and hind margins of both wings edged black, scarcely more than a line; costal margin of secondaries broadly bordered black; the ends of the nervules on primaries edged black for a little distance; on the disk a black sexual narrow bar, broken into three parts, and crossing obliquely the lower median and submedian interspaces; fringes pale black shading into whitish.

Under side pale yellow-ochre of one shade; a little dusky near base of primaries, otherwise immaculate.

Female.—Expands 1.2 inch.

Color of male, the nervules not edged black; immaculate.

Under side as in the male.

From 4 ♂, 2 ♀, part of 18 examples taken in the Mohave Desert, So. California, July, 1882, by Mr. W. G. Wright.

Mr. Wright says: "I have made a four days' trip to reach the Mohave Desert. We went over a pass 6,000 feet high, in the higher portions of which I saw a few Chionobas? but took only three, as they were very skillful in getting into the thorn bushes. Next on the high dry plain, I took a ♀ Anthocharis, perhaps *Lanceolata*. Then it was perfectly dry and barren for 20 miles to Mohave River. About 60 rods from the river came a change in the vegetation, the whole ground being covered with a salt weed somewhat resembling eastern "hog weed," but more branched, and upon the flowers of that I saw these bright little yellow Copæodes. I instantly jumped out and told my companion to go on to the river, and then and there I collected 18 of them. More could have been got, but they were rather lively, and I thought I had enough, especially as I saw other things, one of which was a black species (Amblyscirtes *Libya*). Here also I took a few Pamphila *Sabuleti* and P. *Campestris*. In the desert I saw an orange butterfly" (probably *Terias*), "but could not take it. The flight of this was exceedingly rapid and erratic, and over bushes which rendered pursuit difficult or impossible. These orange

butterflies were always several miles from water. When I went out I thought I should find a good many insects at the watering places, water being so scarce there, but on the contrary, I found few or none there. The springs or wells are 15 to 25 miles apart, and the intervening desert is absolutely dry and parched, yet in good part is covered with bushes of several kinds, cactus, etc., and also sometimes with a monstrous tree, the "Joshua," *Yucca brevifolia*, which looks as if it belonged to another world. No gnats, no mosquitoes, but few birds, no squirrels, very few snakes and those all rattlers, but plenty of sand and so hot! The sun beats down with vertical rays and the air is like that from a furnace. I saw no other butterfly at the river than I have mentioned, except one Danais, small, pale-colored, and it seemed to me differently marked from any I have seen at San Bernardino."

NOTES ON THE LARVA OF BUCCULATRIX AMBROSIÆFOLIELLA.

BY V. T. CHAMBERS, COVINGTON, KY.

This species was described by me in the Cincinnati Quarterly Journal of Science, v. 2, p. 119, and it was said to feed upon the leaves of *Ambrosia trifida*, in the larval stage. Afterwards, in a note in the American Entomologist, I suggested that as it had only been bred from a collection of leaves of that plant, and had not actually been seen feeding, and as some species of *Bucculatrix* sometimes crawl away from their food plants to pupate, it was possible that it might turn out that this larva did not feed upon Ambrosia. This summer, however, I have been fortunate enough to find the larva mining the leaves of *A. trifida*, and also of several varieties of *Helianthus;* indeed it is much more numerous on *Helianthus* than on *Ambrosia*. *Lithocolletis ambrosiæella* and *L. helianthivorella* feeding on the same plants, many would consider only varieties of one species; as also many would consider *Tischeria ambrosiæella* and *T. heliopsisella*, which feed on the same plants, and on *Heliopsis*, varieties of one species. It is a little singular that so many of these minute leaf-mining species should feed on so many varieties and species of *Helianthus* and *Heliopsis*, and all on the single species of *Ambrosia*, and on no other

species of that genus, except that *Tischeria ambrosiæfoliella* feeds also on *Ambrosia artemisifolia*. *Butalis matutella* feeds on *A. trifida* and on Asters; but not, so far as is known, on any other species of *Ambrosia*, nor on *Helianthus* or *Heliopsis*. *A. trifida* seems to be a point from which they radiate, so to speak, to other *Compositæ*.

In the published description of *Bucculatrix ambrosiæfoliella* I find that I have omitted to mention the minute tuft of brown scales on the dorsal margin of the fore wings, and that in the sentence which reads, "the scales between the black internal edging of the arc, and the costal margin, are ochreous," the word "dorsal" should be substituted for "costal."

The larvæ of several species of *Bucculatrix* are known in Europe; but in this country, until now, Dr. Clemens' "mere mention" of the larva of *B. pomifoliella* Clem., is all that has been published. Briefly the larval habits of the genus may be thus summarized: The larva while very young mines in leaves, and leaving the mine, it feeds externally, moulting once in a little cocoonet, and again in a singular ribbed cocoon, where it passes the pupa stage. Dr. Clemens says truly that the larva of *B. pomifoliella* feeds on apple leaves, and pupates "in an elongate, dirty white, ribbed cocoon," but this, with a brief description of the larva in one of its stages, is about all of the information that he gives us about it. *B. pomifoliella* is not uncommon in this region (Kentucky), but I have never met with the larva, and until I met with the larva of *B. ambrosiæfoliella*, larvæ of this genus have been unknown to me.

I have elsewhere suggested that, owing to certain structural resemblances of the pupæ of *Bucculatrix* and *Lithocolletis*, it would be found, when the larva of *Bucculatrix* was dissected, that it belonged to the same larval group with *Lithocolletis*, *Gracillaria*, etc. In this group of larvæ the mouth parts are in the first stages very imperfect, the maxillæ, and both maxillary and labial palpi, are either entirely wanting or very rudimentary, and the other mouth organs are of very different form and structure from that of ordinary caterpillars. At some subsequent moult (first, third or fifth, as the case may be—varying in different genera and species of the group) this "ordinary" form is assumed, and I have therefore usually mentioned the imperfect form as the "first" form, and the other as the "second" or "ordinary" form. My suggestion as to *Bucculatrix* was that, where the mouth parts of the larva in its first stage were examined, it would be found to have mouth parts of the "first" form, because in its pupa state certain structures of the head and 2nd segment

are similar to structures possessed by *Lithocolletis*, *Gracilaria*, and other genera, the larva of which in their early stages have mouth parts of the "first" form. A peculiarity of this "first" form is that, owing to the structure of the mouth parts, the larva possessing them can not feed down into the parenchyma like a larva having trophi of the "ordinary" form, but can only eat in the plane in which the larva lies, consuming a few of the cells of the parenchyma lying next to the cuticle, and leaving all beneath it uneaten; while a larva with the "ordinary" form eats out the whole parenchyma, or at least eats down into it. A glance at the mine of *B. ambrosiæfoliella* was therefore sufficient to show me that my suggestion as to the group to which *Bucculatrix* belongs was unfounded; the entire parenchyma was eaten out, and therefore the trophi were of the "second" form, and different from those of *Lithocolletis*, etc. On closer inspection, however, the earliest part of the mine did not appear to have all of the parenchyma eaten out. Still it did not have the appearance of a mine of a larva having the "first" form of trophi; the eaten portion did not all lie close to the cuticle, but the parenchyma was irregularly eaten into—sometimes eaten almost through—in a way that could not be done by a larva with the "first" form of trophi, but which might have been done by a very young and small larva with trophi of the "second" form, and dissection showed that this was the truth of the matter. The larva never has trophi of the "first" form in any stage.

But among larvæ having trophi of the "second" form, there are sub-groups, each of which presents important differences from the others in the structure of the different organs. Thus, so far as I have examined, all the larvæ of *Rhopalocera* have trophi differing in some respects from those of *Heterocera*, except that the larva of the Tineid, *Plutella cruciferarum*, has larval trophi resembling those of the Skippers. The Attacidæ again form a sub-group. All of the other *Heterocera* again, except some of the Tineids to be presently mentioned, form another sub-group. These "other Tineids" comprise *Cemiostoma*, which stands alone; *Tischeria*, which also stands alone in some respects, whilst in others it resembles *Bedellia*, *Antispila*, *Aspidisca* and some others which are more or less similar to them, though differing from them in some respects, and among these is *Nepticula*. All of these I class in a single sub-group of larvæ. The larval trophi of *Bucculatrix* more nearly resemble those of *Nepticula* than any of the others. Mr. Stainton (not mentioning the larval trophi) has already written of *Bucculatrix*: "This genus offers several points of

resemblance with the next family" *(Nepticulidæ)*, "but the larvæ have six well-developed true legs."—Ins. Brit., v. 3, p. 290. The six legs seem to have been Mr. Stainton's chief, if not only reason, for excluding *Bucculatrix* from *Nepticulidæ*, in which the six true legs "are wanting, and they are replaced by membranous processes or prolegs, yet neither on these segments nor on the remaining segments, each of which is furnished with a pair of prolegs (making eighteen in all), have the prolegs the usual coronet of little hooks" (Ibid, p. 296). Dr. Clemens says of *B. pomifoliella* that the legs are "very small," and though this can not be said of *B. ambrosiæfoliella*, yet its anal prolegs are destitute of the coronet of little hooks, having only a single little spine; while the abdominal prolegs have each only these little claws, rather than the usual tubercles; so that I do not hesitate to place *Bucculatrix* in the same larval group with *Nepticula*. The thoracic feet have each a single claw which is set around with numerous, rather stiff, bristles, and, as hereafter shown, are used to guide the thread in spinning the cocoon. Each segment of the body is clothed with numerous hairs, especially the pro-thoracic segment, where the hairs are stiff and project forward over the head; this segment in the adult larva has twelve microscopic red-brown spots, ten of which are on the back—four of them in the angles of a square, three others obliquely on each side of the square, and one other, larger but more indistinct, on each side; these spots I think are hypodermal.

The egg, a minute colorless globule, is deposited on the upper surface of the leaf, and the larva, leaving it, makes at first a short, tortuous, linear mine, which ends in a small blotch with the frass in compact lines. The first stage lasts probably between three and four days (the youngest larva I have seen was a little more than one-fortieth of an inch long). The larva at this stage is sordid white. Having ceased to feed, it doubles itself in what Mr. Stainton calls horse-shoe shape, the ventral surface of the anterior half being applied to that of the posterior half of the body, and thus it undergoes its first moult in the mine. The larva, when it has cast its old skin, is no longer sordid white, but is striped longitudinally; there is a dorsal green stripe, margined on each side by a white line, beneath which is another green stripe on each side, containing on each segment two white spots placed obliquely, the lower spot being the largest, and the under surface is pale greenish; the larva frequently has a faint pink tinge, and the longitudinal stripes, which are very faint at first, become darker with age. It remains in the mine and feeds for about one day

after its first moult; then leaves it, and feeds externally for about two days, usually on the under side of the leaf, but occasionally also on the upper side. There it spins beside a rib a thin sheet of white silk, beneath which it spins a cocoonet, in which it again assumes the horse-shoe shape, and passes in about a day to second moult. Emerging from its cocoonet, it continues to feed externally for three days, when either on the plant or near to it, it spins its ribbed cocoon, in which it passes the pupa state. I have not observed accurately the length of this stage; in August it is about a week. The mature larva is about three lines long.

I have frequently been puzzled to understand how the larva could spin this singular cocoon, but I have now fortunately been enabled to watch it at work under the microscope. The cocoon shows six longitudinal ribs or ridges, with depressions like valleys between them. Each rib consists of four threads, and is four times as thick as the depressions; the threads of the ribs are longitudinal and rigid, those of the valleys run obliquely transverse, and each is permitted to droop or sag down, and they are spun first from right to left, then from left to right, crossing each other at a somewhat acute angle, the one set being kept always about four threads in advance of the other, the finished portion of the cocoon showing the two threads crossing each other, while the unfinished shows only two threads without any thread crossing them, as shown in fig. 1 at *a* finished, at *b* unfinished, portion of the cocoon.

But properly speaking, this is no part of the cocoon, but only a reticulated frame or net-work, within and attached to which the true cocoon is spun. The whole net-work is a continuous thread, with no break; each transverse thread continues entirely across the cocoon, but the ribs are not continuous threads the length of the cocoon; each rib is made by a multitudinous succession of movements forward and back again, each movement only the length of the space between two transverse threads. Whenever in the transverse movement of the head, the apex of the spinneret touches a rib, it is moved forward and back again. Thus, the larva (having laid the floor or foundation of its reticulated frame-work by spinning its web somewhat densely over the portion of the leaf that is to

be covered by it, and for some little distance around it) reaches at length, we will say, the point *a*, fig. 1, when it is ready to begin the reticulated work. Working backwards, the head is now drawn back and a little out to *a* 3; the claw of the fore foot is here applied to the thread (which has no elasticity, or very little, and which hardens the instant it is fairly out of the spinneret); the head is drawn back along the line towards *a*, as far as *a* 2, where it leaves the hardened thread, using the claw again, and passes obliquely down and forwards again to the foot of the second rib at *c*, where it is attached to the floor, and the thread again bent on the claw, is retracted a little upwards nearly parallel to the line *a* and *a* 3, to the point *d* in the figure, when, again bent on the claw, it is carried forward (adjoining the newly spun thread) to the point *e*, where it leaves the thread (just as it did at *a* 2), and passes obliquely forwards again to the foot of the third rib at *f*, and this is repeated until the spinneret arrives at the point *g* at the base of the other side of the cocoon. It is then carried along the floor of the cocoon back to the point *a* 2, then it is again retracted to the point *a* 4, where it is bent on the claw and advanced again to *a* 3. In retracting the head from *a* to *a* 3, a single thread is left; returning it to *a* 2 adds another thread along that part; from *a* 2 to *c* there is only a single thread; retracting it to *d* leaves a single thread of course, while advancing it to *e* leaves another that far, and the thread leaves the rib, being carried to *f*, as above stated. Thus the base or beginning of each rib (at *a* and *c*, etc.) would consist only of a single thread, but while the spinneret is there it is passed several times up and down that part, and the thread is thus strengthened, and sometimes while at work on the reticulated net, the larva, on reaching the floor, would pass its spinneret over it in various directions, advancing under it up to its very beginning, thickening the floor, and fastening the attachments of the ribs to it, and sometimes retiring and entirely leaving the net-work so far that I thought it had left it finally; but it always returned, and continued its work on the reticulated frame which, as before stated, forms at first only the outer covering of the true cocoon. Hitherto the larva has been building in front of, around and over its head, gradually retiring as the work advanced towards it; therefore to make a line in one of the ribs it would retract its head, while to double the line it would advance its head or spinneret. Each of the obliquely transverse lines was permitted to sag down between the ribs and was long enough to do so by its own weight. To make each line in a rib the head was retracted the distance between three transverse lines, and

then, bending the thread, it was advanced over the space between two of these (that is, about one-hundredth of an inch) to the point where it leaves one rib to proceed to the next one.

But thus far we have each rib composed of only two threads and the transverse lines running in only one direction. How is it as to the other set of obliquely transverse lines which cross the first set? and how are the two additional threads added to each rib? All of this is done precisely as the first set was made. Returning from the side *g b* of the frame, the work is only a repetition in the opposite direction of the work first done as above related. Having finished about three-fourths of the frame, retreating from it and working towards itself, as above stated, the larva now passes up into it, adding to the floor and the foundations as it goes, till having reached the upper end, it doubles upon itself, and reverses its position, protruding about one-fourth of its body through the open end of the frame, which it now begins anew from the other end and repeats here the work already done, until the two portions almost touch. Then it ceases to follow the regular pattern of the reticulation, and by a series of longitudinal threads passed rapidly to and fro, connects the two pieces of the frame much as a tailor darns a rent in a garment, and this darn may be detected even in an old cocoon. The larva is now completely enclosed in the frame work, and immediately begins to spin its cocoon proper within it. This occupies only the central position, not extending into either end of the frame. It works very rapidly, and in three hours from the time that it begins to spin is entirely concealed from sight.

It is very interesting to watch the little architect at work upon its reticulated frame. It evidently understands its trade, whether we call it a house-builder or weaver. It knows exactly what it has to do, and how to do it, and "goes straight along" with its work with an air of as much conscious intelligence and understanding as any other builder of homes either with or without hands. It is difficult to watch its operations without feeling that here is a conscious intelligence at work. All other known species of the genus, save one, make these ribbed cocoons, and to do so they must work much as this one does. How the instinct to make a cocoon, and especially one like this, ever originated—what advantage in "the struggle for existence" the reticulated pattern possesses over a common one in which the threads are carried hither and thither apparently without order or plan—and why this instinct should be lacking in a single species, are questions as unanswerable as why some spiders are

geometricians. I will only add that if the larva ceased to spin when the reticulated frame work is finished, the cocoon would belong to the same class with those of *Plutella cruciferarum* and a few others which pupate simply in an open network.

Fig. 1 is very imperfect. It should represent the transverse lines not only as oblique, but as sagging down more than they do, and should show more clearly that each, on reaching a rib, passes along it, over the space between these lines, and is bent back over the space between two. It is proper, perhaps, to state that the threads harden so quickly, or lose their viscidity so quickly, that two threads in contact seldom adhere except immediately at the point of the spinneret.

I will add that so far as I have examined bred specimens of the imago, those from *Ambrosia* have the markings more sharply defined and the brown scales darker than those from *Helianthus*.

GONILOBA *(Eudamus)* TITYRUS, Fab.—I have within the last few days of the end of August made a capture of numerous specimens of the larvæ of two skippers—hitherto, it has been considered, rather rare in this locality, only an occasional specimen of either larva or butterfly being seen.

On a few locust trees and young second-growth of *Robinia pseudacia*, adjoining my office, I took in about an hour some eighty specimens, and I am satisfied a very little exertion would have procured another hundred; on a subsequent search I also found them in another locality some distance off. The larvæ were nearly all three parts grown, and some just beginning to enter the pupal stage; in only one or two instances did I discover very young specimens. It is worthy of note that I only saw three specimens of the butterfly this summer, so that it could not have been very common. Dr. Harris says "that the viscid locust tree is sometimes almost completely stripped of its leaves by these insects, or presents only here and there the brown and withered remains of foliage which has served as a temporary shelter to the caterpillars." I could not see, however, that the larvæ had done any appreciable harm to the trees on which I found them, although their numbers would have led me to look for very material injury. I would state also that in some seven or eight instances in examining the empty leafy cases formed by the larvæ, I found single specimens of *Clytus pictus*, who seemed to enjoy the cool retreat thus provided for them from the heat of the sun.

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